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A STUDY OF PRODUCTIVITY, RESEARCH ACTIVITIES, AND POSITIONS  
OF POST-WAR PH.D.'S IN MATHEMATICS.

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MANPOWER DEVELOPMENT, MATHEMATICS TEACHERS, MATHEMATICIANS,  
PERFORMANCE, RESEARCH, SCIENTIFIC MANPOWER, TEACHER  
EVALUATION,

THIS REPORT PROVIDES INFORMATION ABOUT THE PUBLICATIONS  
AND PRESENT ACTIVITIES OF THE APPROXIMATELY 5,700 PH.D.'S IN  
MATHEMATICS GIVEN BY UNIVERSITIES IN THE UNITED STATES AND  
CANADA FROM 1945-65. THIS REPORT, COVERING THE 20-YEAR  
POST-WAR PERIOD, IS AN EXTENSION OF AN EARLIER ANALYSIS OF  
THE MATHEMATICS PH.D.'S GIVEN IN 1951. A VARIETY OF SOURCES  
WAS USED TO DETERMINE INFORMATION INCLUDING (1) THE NAMES OF  
THE PH.D. GRADUATES IN MATHEMATICS, (2) PRESENT POSITIONS AND  
FACULTY RANKS OF THE MEMBERS OF THE CLASSES STUDIED, AND (3)  
THE NUMBER OF PAPERS AND BOOKS PUBLISHED BY EACH PERSON.  
REPORTED ARE (1) THE TYPE OF EMPLOYMENT AND, FOR UNIVERSITY  
PERSONNEL, THE FACULTY RANK WHERE APPLICABLE FOR EACH CLASS,  
(2) THE DISTRIBUTION OF NUMBER OF PUBLICATIONS FOR EACH  
CLASS, (3) COMPARISONS BETWEEN THE PAPERS PUBLISHED BY  
PROFESSORS AT DIFFERENT TYPES OF UNIVERSITIES, (4) THE  
PERCENTAGES, FOR EACH CLASS, OF THOSE WHO HAVE PUBLISHED NO  
PAPERS, ONE PAPER, AND MORE THAN ONE PAPER, AND (5) THE  
NUMBER AND PERCENTAGE OF EACH CLASS WHO HAVE PUBLISHED AT A  
RATE OF MORE THAN ONE PAPER PER YEAR. ACCORDING TO THE  
CALCULATIONS, WHICH WERE DONE FOR THIS REPORT, IT WAS  
ESTIMATED THAT IN 1965 THERE WERE ROUGHLY 700 UNIVERSITY  
MATHEMATICIANS AVAILABLE WHO MET THE STANDARD OF HAVING  
PUBLISHED A PAPER A YEAR. WHEN CONSIDERING THE SIZE OF THE  
POOL OF 700 QUALIFIED THESIS DIRECTORS, THE GOALS STATED IN  
THE GILLILAND REPORT OF BETWEEN 1,300 AND 2,200 PH.D.'S PER  
YEAR IN MATHEMATICS BY 1970 SEEM IMPLAUSIBLY HIGH. (RP)

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A STUDY OF PRODUCTIVITY, RESEARCH ACTIVITIES, AND POSITIONS OF  
POST-WAR Ph.D.'s IN MATHEMATICS

G. S. Young

In the twenty-year post-war period, 1945-65, there have been approximately 5,700 Ph.D.'s in mathematics given by universities in the United States and Canada. The purpose of this report is to say something about their publications and their present activities and to discuss some of the implications of these facts. This study is an extension of an earlier analysis [7] of the mathematics Ph.D.'s given in the year 1951. The present report is based on comparable data for the Ph.D. classes of 1945, 1948, 1954, 1957, 1960, and 1962.

1. Procedure The names of the Ph.D. graduates in mathematics were taken from a list of such degrees published annually by the American Mathematical Society.

The present positions and faculty ranks of the members of the classes studied were determined by looking first in the Combined Membership List, which is published jointly by the American Mathematical Society, the Mathematical Association of America, and the Society for Industrial and Applied Mathematics. This list includes all persons who are members of any of these organizations. Next the latest issue of the American men of Science was examined. For people still unlocated, a letter was written to the Graduate School asking the Graduate School for information as to the person's whereabouts. If a person was located through the Graduate School, but insufficient detail was given as to his present employment, a letter was written to him asking for further information. A surprising number of people remained unlocated by any of the means; it is my subjective impression that for the most part these were students of foreign origin who have returned home, or persons taking degrees in areas such as computing or operations research somewhat out of the main stream of mathematics and who have found employment outside the normal mathematical fields. However, it is clearer that some of the people we have not been able to locate are deceased, and some of them are women who have married and changed their names, and perhaps been removed from the field.

The number of papers and books published by each person was determined by searching the index of the Mathematical Reviews. Mathematical Reviews does not attempt to review elementary textbooks so the books reviewed there and entered in the tables of this report are mainly scholarly books or advanced textbooks. However, this does not entirely account for the small number of books; independent evidence from the recent COLFACS survey [6] indicates that mathematicians as a group are less prolific publishers of books (and papers) than are those in other disciplines.

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Another and more important consequence of using the Mathematical Reviews to determine publications is that, due to delay in reviewing, the totals represent papers published through 1963 or 1964. Thus the productivity of the class of 1962 is probably understated; to a smaller extent this is probably also true of the class of 1960.

In the tables which follow, the term "University" is used to include all institutions of higher education; the term "Industry" includes employment by corporations or self-employment or anything else that is clearly not teaching or government work. The term "unknown" means that the person was not located by the measure described above. The category "Foreign" is composed of persons receiving Ph.D.'s in mathematics from American universities but now residing abroad.

2. Positions Table 1 gives successively class by class the type of employment and, for university personnel, the faculty rank where applicable. The distribution of all 1554 Ph.D.'s covered by the survey is as follows:

|                      | N    | Per-<br>cent |
|----------------------|------|--------------|
| University           | 962  | 61.9         |
| Industry             | 194  | 12.5         |
| Government           | 46   | 3.0          |
| Foreign              | 100  | 6.4          |
| Deceased and Unknown | 252  | 16.2         |
| Total                | 1554 | 100          |

There were 5700 Ph.D.'s in mathematics given between 1945 and 1965. The application of these percentages to the larger number gives

|                      | N    |
|----------------------|------|
| University           | 3528 |
| Industry             | 713  |
| Government           | 171  |
| Deceased and Unknown | 923  |
| Foreign              | 365  |
| Total                | 5700 |

A crude application of standard mortality tables to the number of Ph.D.'s granted in each year before 1945 gives a guess that in 1965 there were still alive and still under 65 some 800 mathematicians with Ph.D.'s from before 1945.

So, as a rough estimate, there were approximately 6000 American trained mathematics Ph.D.'s in the labor force at the end of 1965.

It is interesting to speculate about the category, Deceased and Unknown. The mathematicians covered in this survey all are young enough that the actual number of deceased persons must be quite small. Unless most of the balance are in industry, the industrial community is making do with a surprisingly small number of Ph.D. mathematicians.

One thing that is probably true is that very few in the "unknown" category are in universities. Let us suppose for the purposes of making comparisons, that none are in universities, a pessimistic assumption from the standpoint of college teaching.

The figure of 61.9 percent in college teaching is higher than that given for most years by Maul [3] for the percentage of new mathematics doctorates entering or remaining in college teaching. If the figures of the present study are correct, it follows either that Maul's figures are unduly low or that the net flow of mathematics Ph.D.'s after their first post-doctoral job has been from industry into teaching contrary to the popularly held belief that the new flow has been out of teaching into other employment.

It is worth remarking that if the 61.9 percent figure is multiplied by the number of Ph.D.'s from 1945 to 1962 (rather than 1965) and if it is assumed that virtually all pre-war Ph.D.'s who are still active are in college teaching, the result is in substantial agreement with the results of the Office of Education COLFACS Survey [6] done in 1962-63.

Table 1 also lists class by class the mean number of papers published by professors of different faculty ranks. The tables show vividly the influence of publication on promotion. The university professors as a group are consistently more prolific than other groups.

3. Publications Table 2 gives the distribution of number of publications for each class. These distributions are all roughly similar in general shape. The number who have published no papers or only one paper is mildly surprising. Out of 1148 Ph.D.'s in all of the classes excluding 1962, a total of 339 had published nothing and 222 had published only one paper. Thus almost exactly half can be said to have published nothing except possibly their theses.

The class of 1962 is a special case. Only 16 percent of this class had published more than one paper. This extremely low percentage is almost certainly due to the short time which the members of the class have had to produce papers - barely enough time to have a paper published and reviewed. In reading Table 2 one should keep in mind that the figures are not publication rates but total accumulations so that comparisons among classes should be made with caution.

Table 3 gives comparisons between the papers published by professors at different types of universities. The author selected a list of what he felt were the strongest 25 departments and measured rank and publication in these; he then did the same for the other schools. The recent Cartter study by the ACE gives a list of the 25 strongest

departments in mathematics. The author measured rank and publication in these schools; he then did the same for the other schools. Table 3 also gives publication rates in the last column. These were determined by dividing the mean number of papers for a certain group by the number of years the members of that group have had since their Ph.D.'s were granted. It is interesting to compute for each class the percentage of professors who teach at the 25 strong schools:

| <u>Class</u> | <u>Percent at the 25 Strong Schools</u> |
|--------------|-----------------------------------------|
| 1945         | 29                                      |
| 1948         | 40                                      |
| 1951         | 42                                      |
| 1954         | 31                                      |
| 1957         | 29                                      |
| 1960         | 34                                      |
| 1962         | 30                                      |

Table 4 gives for each class the percentages who have published no papers, one paper, and more than one paper.

Table 5 shows the number and percentage of each class who have published at a rate of more than one paper per year. The trend is definitely downward with time. It is tempting but probably hazardous to draw conclusions from this about the trends in quality of Ph.D.'s.

4. Implications Combining the data of the present study with data from other sources, it is possible to make a rough estimate of the total number of mathematicians who were qualified to direct Ph.D. thesis, say, in 1965. The report of a recent Conference Board meeting of Manpower Problems in the Training of Mathematicians [2] gives a paper a year as a crude quantitative measure of publication to tell whether a person should supervise theses.

First of all, studies by H. O. Pollak [4] indicate that the Ph.D.'s of 1963 and 1964 probably produced almost no Ph.D.'s in 1965, so we exclude these classes from consideration as prospective thesis supervisors.

From Table 5 together with the number of Ph.D.'s given in the classes covered by this study, I calculate that 12.4 percent of the Ph.D.'s in these years have published more than one paper a year. Omitting the class of 1962 raises the percentage to 14.4. Applying the percentage to the total number of Ph.D.'s produced in the years 1945 through 1962 gives an estimate of 554 potential thesis supervisors available from this source. To this must be added some estimate of the available thesis supervisors trained in years prior to 1945. Applying the 14.4 percent to the previously estimated 800 such persons gives an additional 115 Ph.D. supervisors in 1965 or a total of 670.

To this figure should be added mathematicians having foreign doctorates. Pollak's data give 97 people with foreign doctorates who actually directed at least one thesis at an American university during the seven year period 1957-63. Adding all of these to the previous total gives 767.

From these figures must be subtracted the number of otherwise qualified persons who because of employment outside American universities are unable to direct theses. The various parts of Table 1 confirm the intuitive impression that the publication rates of mathematicians outside universities are much lower than those of university mathematicians and hence this group would be expected to contain a smaller proportion of persons meeting the publication requirements of at least a paper a year. Applying a 7 percent rate to industry and government, a 14.4 percent rate to foreign mathematicians trained in the United States and a zero percent rate to those deceased and unknown, one obtains a total of 98 potential thesis supervisors outside universities, almost exactly counteracting the number of thesis supervisors of foreign origin. This gives a crude estimate of 669, which I round off to 700.

So there was available in 1965 a pool of roughly 700 mathematicians in universities who meet the standard of having published a paper a year.

The Pollak study referred to earlier found a total of 811 professors who had directed at least one Ph.D. thesis during the seven year period 1957-1963. Not all of these could be in our pool of 700 but 330 out of these 811 directed only one thesis and thus might be thought of as occasional thesis directors. Only 13 percent of the professors in Pollak's study directed theses at the rate of at least one a year during this seven year period. Many of these probably did so due to a "bunching phenomenon"; only a very few of the 13 percent could be expected to produce students at the rate of one a year over a long period of time. The most common rate of Ph.D. production was between .4 and .6 per year.

Considering the size of the pool of 700 qualified thesis directors and the rates of performance of Ph.D. thesis directors as recorded by Pollak, the goals stated in the Gilliland report [5] of between 1300 and 2200 Ph.D.'s per year in mathematics by 1970 seem implausibly high.

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TABLE 1. LOCATION AND RANK OF Ph.D.'s IN MATHEMATICS

Class of 1945

| Group         | Number |      | Papers |      | Mean Number<br>of Papers |
|---------------|--------|------|--------|------|--------------------------|
|               | N      | %    | N      | %    |                          |
| Univ.Per.     |        |      |        |      |                          |
| Prof.         | 13     | 50.0 | 242    | 89.3 | 18.6                     |
| Asso. Prof.   | 4      | 15.4 | 3      | 1.1  | .8                       |
| Asst. Prof.   | 0      | 0    | 0      | 0    | 0                        |
| Admin.        | 0      | 0    | 0      | 0    | 0                        |
| Other         | 0      | 0    | 0      | 0    | 0                        |
| Unknown       | 0      | 0    | 0      | 0    | 0                        |
| All Univ.Per. | 17     | 65.4 | 245    | 90.4 | 14.4                     |
| Academic      | 1      | 3.8  | 0      | 0    | 0                        |
| Industry      | 2      | 7.7  | 2      | .7   | 1.0                      |
| Government    | 0      | 0    | 0      | 0    | 0                        |
| Foreign       | 1      | 3.8  | 2      | .7   | 2.0                      |
| Deceased      | 3      | 11.5 | 21     | 7.7  | 7.0                      |
| Unknown       | 2      | 7.7  | 1      | .4   | .5                       |
| Total         | 26     | 99.9 | 271    | 99.9 | 10.4                     |

### Class of 1948

| Group         | Number |       | Publication |       |         |       | Mean<br>Number<br>of Papers |
|---------------|--------|-------|-------------|-------|---------|-------|-----------------------------|
|               | N      | %     | Number      |       | Percent |       |                             |
|               |        |       | Papers      | Books | Papers  | Books |                             |
| Univ. Per.    |        |       |             |       |         |       |                             |
| Prof.         | 57     | 46.3  | 955         | 10    | 71.1    | 76.9  | 16.8                        |
| Asso.Prof.    | 15     | 12.2  | 83          | 0     | 6.2     | 0     | 5.5                         |
| Asst.Prof.    | 4      | 3.3   | 9           | 0     | 7       | 0     | 2.3                         |
| Admin.        | 2      | 1.6   | 2           | 0     | .1      | 0     | 1.0                         |
| Other         | 3      | 2.4   | 5           | 2     | .4      | 15.4  | 1.7                         |
| Unknown       | 5      | 4.1   | 21          | 0     | 1.6     | 0     | 4.2                         |
| All Univ.Per. | 86     | 69.9  | 1075        | 12    | 80.1    | 92.3  | 12.5                        |
| Industry      | 9      | 7.3   | 40          | 0     | 3.0     | 0     | 4.4                         |
| Government    | 4      | 3.3   | 3           | 0     | .2      | 0     | .8                          |
| Foreign       | 6      | 4.9   | 32          | 0     | 2.4     | 0     | 5.3                         |
| Deceased      | 2      | 1.6   | 41          | 0     | 3.0     | 0     | 20.5                        |
| Unknown       | 16     | 13.0  | 152         | 1     | 11.3    | 7.7   | 9.5                         |
| Total         | 123    | 100.0 | 1343        | 13    | 100.0   | 100.0 | 10.9                        |

### Class of 1951

| Group                 | Number |       | Papers |       | Mean Number<br>of Papers |
|-----------------------|--------|-------|--------|-------|--------------------------|
|                       | N      | %     | N      | %     |                          |
| Univ. Per.            |        |       |        |       |                          |
| Prof.                 | 68     | 31.4  | 584    | 49.9  | 8.6                      |
| Asso.Prof.            | 45     | 20.7  | 222    | 19.0  | 4.9                      |
| Asst.Prof.            | 13     | 6.0   | 79     | 6.8   | 6.1                      |
| Admin.                | 18     | 8.3   | 68     | 5.8   | 3.8                      |
| All Univ. Per.        | 144    | 66.4  | 953    | 81.5  | 6.6                      |
| Industry<br>and Govt. | 45     | 20.7  | 130    | 11.1  | 2.9                      |
| Unknown               | 28     | 12.9  | 87     | 7.4   | 3.1                      |
| Total                 | 217    | 100.0 | 1,170  | 100.0 | 5.4                      |

Class of 1954

| Group         | Number |      | Publication |       |         |       | Mean<br>Number of<br>Papers |
|---------------|--------|------|-------------|-------|---------|-------|-----------------------------|
|               | N      | %    | Number      |       | Percent |       |                             |
|               |        |      | Papers      | Books | Papers  | Books |                             |
| Univ. Per     |        |      |             |       |         |       |                             |
| Prof.         | 72     | 29.1 | 584         | 5     | 46.2    | 62.5  | 8.1                         |
| Asso.Prof.    | 56     | 22.6 | 282         | 1     | 22.3    | 12.5  | 5.0                         |
| Asst.Prof.    | 14     | 5.6  | 61          | 1     | 4.9     | 12.5  | 4.4                         |
| Admin.        | 0      | 0    | 0           | 0     | 0       | 0     | 0                           |
| Other         | 4      | 1.6  | 22          | 0     | 1.7     | 0     | 5.5                         |
| Unknown       | 3      | 1.2  | 12          | 0     | .9      | 0     | 4.0                         |
| All Univ.Per. | 149    | 60.1 | 961         | 7     | 76.0    | 87.5  | 6.4                         |
| Industry      | 33     | 13.3 | 95          | 1     | 7.5     | 12.5  | 2.9                         |
| Government    | 9      | 3.6  | 19          | 0     | 1.5     | 0     | 2.1                         |
| Foreign       | 14     | 5.6  | 54          | 0     | 4.3     | 0     | 3.9                         |
| Deceased      | 3      | 1.2  | 3           | 0     | .2      | 0     | 1.0                         |
| Unknown       | 40     | 16.1 | 132         | 0     | 10.4    | 0     | 3.3                         |
| Total         | 248    | 99.9 | 1264        | 8     | 99.9    | 100.0 | 5.1                         |

Class of 1957

| Group        | <u>Number</u> |       | <u>Publication</u> |       |                |       | Mean<br>Number of<br>Papers |
|--------------|---------------|-------|--------------------|-------|----------------|-------|-----------------------------|
|              | N             | %     | <u>Number</u>      |       | <u>Percent</u> |       |                             |
|              |               |       | Papers             | Books | Papers         | Books |                             |
| Univ.Per.    |               |       |                    |       |                |       |                             |
| Prof.        | 38            | 16.8  | 152                | 2     | 23.9           | 50.0  | 4.0                         |
| Asso. Prof.  | 60            | 26.5  | 224                | 0     | 35.3           | 0     | 3.7                         |
| Asst. Prof.  | 16            | 7.1   | 35                 | 0     | 5.5            | 0     | 2.2                         |
| Admin.       | 2             | .9    | 0                  | 0     | 0              | 0     | 0                           |
| Other        | 7             | 3.1   | 25                 | 0     | 3.9            | 0     | 3.6                         |
| Unknown      | 3             | 1.3   | 2                  | 0     | .3             | 0     | .7                          |
| All Univ.Per | 126           | 55.7  | 438                | 2     | 68.9           | 50.0  | 3.5                         |
| Industry     | 36            | 15.9  | 65                 | 1     | 10.2           | 25.0  | 1.8                         |
| Government   | 9             | 4.0   | 9                  | 0     | 1.4            | 0     | 1.0                         |
| Foreign      | 11            | 4.9   | 47                 | 1     | 7.4            | 25.0  | 4.3                         |
| Deceased     | 0             | 0     | 0                  | 0     | 0              | 0     | 0                           |
| Unknown      | 44            | 19.5  | 76                 | 0     | 12.0           | 0     | 1.7                         |
| Total        | 226           | 100.0 | 635                | 4     | 99.9           | 100.0 | 2.8                         |

# Class of 1960

| Group         | Number |      | Publication |       |         |       | Mean<br>Number of<br>Papers |
|---------------|--------|------|-------------|-------|---------|-------|-----------------------------|
|               | N      | %    | Number      |       | Percent |       |                             |
|               |        |      | Papers      | Books | Papers  | Books |                             |
| Univ.Per.     |        |      |             |       |         |       |                             |
| Prof.         | 15     | 4.9  | 31          | 0     | 5.7     | 0     | 2.1                         |
| Asso.Prof.    | 63     | 20.5 | 162         | 1     | 29.7    | 50.0  | 2.6                         |
| Asst.Prof     | 73     | 23.7 | 131         | 0     | 24.0    | 0     | 1.8                         |
| Admin.        | 2      | .6   | 0           | 0     | 0       | 0     | 0                           |
| Other         | 17     | 5.5  | 32          | 0     | 5.9     | 0     | 1.9                         |
| Unknown       | 10     | 3.2  | 21          | 1     | 3.9     | 50.0  | 2.1                         |
| All Univ.Per. | 180    | 58.4 | 377         | 2     | 69.2    | 100.0 | 2.1                         |
| Industry      | 35     | 11.4 | 34          | 0     | 6.2     | 0     | 1.0                         |
| Government    | 9      | 2.9  | 14          | 0     | 2.6     | 0     | 1.6                         |
| Foreign       | 29     | 9.4  | 58          | 0     | 10.6    | 0     | 2.0                         |
| Deceased      | 2      | .6   | 2           | 0     | .4      | 0     | 1.0                         |
| Unknown       | 51     | 16.6 | 59          | 0     | 10.8    | 0     | 1.2                         |
| Total         | 308    | 99.9 | 545         | 2     | 100.0   | 100.0 | 1.8                         |

# Class of 1962

| Group         | Number |      | Publication |       |         |       | Mean<br>Number of<br>Papers |
|---------------|--------|------|-------------|-------|---------|-------|-----------------------------|
|               | N      | %    | Number      |       | Percent |       |                             |
|               |        |      | Papers      | Books | Papers  | Books |                             |
| Univ. Per.    |        |      |             |       |         |       |                             |
| Prof.         | 8      | 2.0  | 7           | 0     | 2.5     | 0     | .9                          |
| Asso.Prof.    | 31     | 7.6  | 15          | 0     | 5.4     | 0     | .5                          |
| Asst.Prof.    | 164    | 40.4 | 114         | 3     | 41.2    | 100.0 | .7                          |
| Admin.        | 1      | .2   | 1           | 0     | .4      | 0     | 1.0                         |
| Other         | 21     | 5.2  | 14          | 0     | 5.1     | 0     | .7                          |
| Unknown       | 35     | 8.6  | 27          | 0     | 9.7     | 0     | .8                          |
| All Univ.Per. | 260    | 64.0 | 178         | 3     | 64.3    | 100.0 | .7                          |
| Industry      | 33     | 8.1  | 18          | 0     | 6.5     | 0     | .5                          |
| Government    | 15     | 3.7  | 11          | 0     | 4.0     | 0     | .7                          |
| Foreign       | 39     | 9.6  | 32          | 0     | 11.6    | 0     | .8                          |
| Deceased      | 0      | 0    | 0           | 0     | 0       | 0     | 0                           |
| Unknown       | 59     | 14.5 | 38          | 0     | 13.7    | 0     | .6                          |
| Total         | 406    | 99.9 | 277         | 3     | 100.1   | 100.0 | .7                          |

TABLE 2. DISTRIBUTION OF PUBLISHED PAPERS

| Class of 1945       |                   |            |
|---------------------|-------------------|------------|
| Number of Papers    | Number of Persons | Cumulative |
| $60 \geq n \geq 50$ | 2                 | 2          |
| $50 > n \geq 40$    | 1                 | 3          |
| $40 > n \geq 30$    | 1                 | 4          |
| $30 > n \geq 20$    | 1                 | 5          |
| $20 > n \geq 10$    | 2                 | 7          |
| $10 > n \geq 5$     | 2                 | 9          |
| $n = 4$             | 0                 | 9          |
| $n = 3$             | 1                 | 10         |
| $n = 2$             | 3                 | 13         |
| $n = 1$             | 4                 | 17         |
| $n = 0$             | 9                 | 26         |

Note: The largest number was 59.

| Class of 1948    |                   |            |
|------------------|-------------------|------------|
| Number of Papers | Number of Persons | Cumulative |
| $\geq 90$        | 1                 | 1          |
| $90 > n \geq 80$ | 0                 | 1          |
| $80 > n \geq 70$ | 1                 | 2          |
| $70 > n \geq 60$ | 1                 | 3          |
| $60 > n \geq 50$ | 2                 | 5          |
| $50 > n \geq 40$ | 5                 | 10         |
| $40 > n \geq 30$ | 3                 | 13         |
| $30 > n \geq 20$ | 11                | 24         |
| $20 > n \geq 10$ | 16                | 40         |
| $10 > n \geq 5$  | 16                | 56         |
| $n = 4$          | 8                 | 64         |
| $n = 3$          | 10                | 74         |
| $n = 2$          | 10                | 84         |
| $n = 1$          | 15                | 99         |
| $n = 0$          | 24                | 123        |

Note: The largest number was 92.

### Class of 1951

| Number of Papers | Number of Persons | Cumulative |
|------------------|-------------------|------------|
| $\geq 20$        | 16                | 16         |
| $20 > n \geq 10$ | 24                | 40         |
| $10 > n \geq 5$  | 42                | 82         |
| $n = 4$          | 13                | 95         |
| $n = 3$          | 18                | 113        |
| $n = 2$          | 20                | 133        |
| $n = 1$          | 44                | 177        |
| $n = 0$          | 40                | 217        |

### Class of 1954

| Number of Papers    | Number of Persons | Cumulative |
|---------------------|-------------------|------------|
| $70 \geq n \geq 60$ | 1                 | 1          |
| $60 > n \geq 50$    | 0                 | 1          |
| $50 > n \geq 40$    | 3                 | 4          |
| $40 > n \geq 30$    | 0                 | 4          |
| $30 > n \geq 20$    | 7                 | 11         |
| $20 > n \geq 10$    | 34                | 45         |
| $10 > n \geq 5$     | 39                | 84         |
| $n = 4$             | 10                | 94         |
| $n = 3$             | 23                | 117        |
| $n = 2$             | 29                | 146        |
| $n = 1$             | 39                | 185        |
| $n = 0$             | 63                | 248        |

The largest Number was 67.

### Class of 1957

| Number of Papers    | Number of Persons | Cumulative |
|---------------------|-------------------|------------|
| $30 \geq n \geq 20$ | 3                 | 3          |
| $20 > n \geq 10$    | 14                | 17         |
| $10 > n \geq 5$     | 34                | 51         |
| n = 4               | 9                 | 60         |
| n = 3               | 14                | 74         |
| n = 2               | 19                | 93         |
| n = 1               | 52                | 145        |
| n = 0               | 81                | 226        |

Note: The largest number published was 23

### Class of 1960

| Number of Papers    | Number of Persons | Cumulative |
|---------------------|-------------------|------------|
| $20 \geq n \geq 10$ | 3                 | 3          |
| $10 > n \geq 5$     | 32                | 35         |
| n = 4               | 21                | 56         |
| n = 3               | 27                | 83         |
| n = 2               | 35                | 118        |
| n = 1               | 68                | 186        |
| n = 0               | 122               | 308        |

The largest number published was 13

### Class of 1962

| Number of Papers | Number of Persons | Cumulative |
|------------------|-------------------|------------|
| n=12             | 1                 | 1          |
| n=11             | 0                 | 1          |
| n=10             | 0                 | 1          |
| n=9              | 0                 | 1          |
| n=8              | 1                 | 2          |
| n=7              | 1                 | 3          |
| n=6              | 0                 | 3          |
| n=5              | 3                 | 6          |
| n=4              | 3                 | 9          |
| n=3              | 17                | 26         |
| n=2              | 39                | 65         |
| n=1              | 94                | 159        |
| n=0              | 247               | 406        |

TABLE 3. SCHOOLS, RANKS, AND PUBLICATIONS

Class of 1945

| Group                      | Number |       | Papers |       | Mean<br>Number of<br>Papers | Mean $\pm$<br>19 Yrs. |
|----------------------------|--------|-------|--------|-------|-----------------------------|-----------------------|
|                            | N      | %     | N      | %     |                             |                       |
| Twenty-five Strong Schools |        |       |        |       |                             |                       |
| Prof.                      | 5      | 29.4  | 159    | 64.9  | 31.8                        | 1.67                  |
| Assoc. Prof.               | 0      | 0     | 0      | 0     | 0                           |                       |
| Asst. Prof.                | 0      | 0     | 0      | 0     | 0                           |                       |
| Admin.                     | 0      | 0     | 0      | 0     | 0                           |                       |
| Other                      | 0      | 0     | 0      | 0     | 0                           |                       |
| Unknown                    | 0      | 0     | 0      | 0     | 0                           |                       |
| Total                      | 5      | 29.4  | 159    | 64.9  | 31.8                        |                       |
| Other Universities         |        |       |        |       |                             |                       |
| Prof.                      | 8      | 47.1  | 83     | 33.9  | 10.375                      | .55                   |
| Assoc. Prof.               | 4      | 23.5  | 3      | 1.2   | .75                         | .04                   |
| Asst. Prof.                | 0      | 0     | 0      | 0     | 0                           | 0                     |
| Admin.                     | 0      | 0     | 0      | 0     | 0                           | 0                     |
| Other                      | 0      | 0     | 0      | 0     | 0                           |                       |
| Unknown                    | 0      | 0     | 0      | 0     | 0                           |                       |
| Total                      | 12     | 70.6  | 86     | 35.1  | 7.2                         |                       |
| All Universities           |        |       |        |       |                             |                       |
| Prof.                      | 13     | 76.5  | 242    | 98.8  | 18.615                      | .98                   |
| Assoc. Prof.               | 4      | 23.5  | 3      | 1.2   | .75                         | .04                   |
| Asst. Prof.                | 0      | 0     | 0      | 0     | 0                           |                       |
| Admin.                     | 0      | 0     | 0      | 0     | 0                           |                       |
| Other                      | 0      | 0     | 0      | 0     | 0                           |                       |
| Unknown                    | 0      | 0     | 0      | 0     | 0                           |                       |
| Total                      | 17     | 100.0 | 245    | 100.0 | 14.4                        |                       |

Class of 1948

| Group                      | Number |       | Papers |       | Mean Number<br>of Papers | Mean $\div$<br>16 Yrs. |
|----------------------------|--------|-------|--------|-------|--------------------------|------------------------|
|                            | N      | %     | N      | %     |                          |                        |
| Twenty-five Strong Schools |        |       |        |       |                          |                        |
| Prof.                      | 23     | 26.7  | 671    | 62.4  | 29.174                   | 1.82                   |
| Asso. Prof.                | 4      | 4.7   | 47     | 4.4   | 11.75                    | .73                    |
| Asst. Prof.                | 1      | 1.2   | 5      | .5    | 5.0                      | .31                    |
| Admin.                     | 1      | 1.2   | 2      | .2    | 2.0                      |                        |
| Other                      | 3      | 3.5   | 5      | .5    | 1.7                      |                        |
| Unknown                    | 2      | 2.3   | 17     | 1.6   | 8.5                      |                        |
| Total                      | 34     | 39.6  | 747    | 69.6  | 22.0                     |                        |
| Other Universities         |        |       |        |       |                          |                        |
| Prof.                      | 34     | 39.5  | 284    | 26.4  | 8.353                    | .52                    |
| Asso. Prof.                | 11     | 12.8  | 36     | 3.3   | 3.273                    | .20                    |
| Asst. Prof.                | 3      | 3.5   | 4      | .4    | 1.333                    | .08                    |
| Admin.                     | 1      | 1.2   | 0      | 0     | 0                        |                        |
| Other                      | 0      | 0     | 0      | 0     | 0                        |                        |
| Unknown                    | 3      | 3.5   | 4      | .4    | 1.3                      |                        |
| Total                      | 52     | 60.5  | 328    | 30.5  | 6.3                      |                        |
| All Universities           |        |       |        |       |                          |                        |
| Prof.                      | 57     | 66.2  | 955    | 88.8  | 16.754                   | 1.05                   |
| Asso. Prof.                | 15     | 17.5  | 83     | 7.7   | 5.533                    | .35                    |
| Asst. Prof.                | 4      | 4.7   | 9      | .9    | 2.25                     | .14                    |
| Admin.                     | 2      | 2.4   | 2      | .2    | 1.0                      |                        |
| Other                      | 3      | 3.5   | 5      | .5    | 1.7                      |                        |
| Unknown                    | 5      | 5.8   | 21     | 2.0   | 4.2                      |                        |
| Total                      | 86     | 100.1 | 1075   | 100.1 | 12.5                     |                        |

Class of 1951

| Group                       | Number |       | Papers |       | Mean Number<br>of Papers | Mean $\frac{2}{3}$<br>13 Yrs. |
|-----------------------------|--------|-------|--------|-------|--------------------------|-------------------------------|
|                             | N      | %     | N      | %     |                          |                               |
| Twenty -five Strong Schools |        |       |        |       |                          |                               |
| Prof.                       | 29     | 20.1  | 435    | 45.6  | 15.0                     | 1.15                          |
| Assoc. Prof.                | 17     | 11.8  | 107    | 11.2  | 6.3                      | .48                           |
| Asst. Prof.                 | 6      | 4.2   | 51     | 5.4   | 8.5                      | .65                           |
| Other                       | 9      | 6.3   | 58     | 6.1   | 6.4                      |                               |
| Total                       | 61     | 42.4  | 651    | 68.3  | 10.7                     |                               |
| Other Universities          |        |       |        |       |                          |                               |
| Prof.                       | 39     | 27.1  | 149    | 15.6  | 3.8                      | .29                           |
| Assoc. Prof.                | 28     | 19.4  | 115    | 12.1  | 4.1                      | .32                           |
| Asst. Prof.                 | 7      | 4.9   | 28     | 2.9   | 4.0                      | .31                           |
| Other                       | 9      | 6.2   | 10     | 1.1   | 1.1                      | .31                           |
| Total                       | 83     | 57.6  | 302    | 31.7  | 3.6                      |                               |
| All Universities            |        |       |        |       |                          |                               |
| Prof.                       | 68     | 47.2  | 584    | 61.3  | 8.6                      | .66                           |
| Assoc. Prof.                | 45     | 31.3  | 222    | 23.3  | 4.9                      | .38                           |
| Asst. Prof.                 | 13     | 9.0   | 79     | 8.3   | 6.1                      | .47                           |
| Other                       | 18     | 12.5  | 66     | 7.1   | 3.8                      | .31                           |
| Total                       | 144    | 100.0 | 953    | 100.1 |                          |                               |

Class of 1954

| Group                      | Number |       | Papers |       | Mean Number<br>of Papers | Mean $\frac{1}{10}$<br>10 yrs. |
|----------------------------|--------|-------|--------|-------|--------------------------|--------------------------------|
|                            | N      | %     | N      | %     |                          |                                |
| Twenty-five Strong Schools |        |       |        |       |                          |                                |
| Prof.                      | 23     | 15.4  | 288    | 30.0  | 12.522                   | 1.25                           |
| Asso. Prof.                | 15     | 10.1  | 131    | 13.6  | 8.733                    | .87                            |
| Asst. Prof.                | 5      | 3.4   | 46     | 4.8   | 9.2                      | .92                            |
| Admin.                     | 0      | 0     | 0      | 0     | 0                        | 0                              |
| Other                      | 3      | 2.0   | 20     | 2.1   | 6.7                      |                                |
| Unknown                    | 0      | 0     | 0      | 0     | 0                        |                                |
| Total                      | 46     | 30.9  | 485    | 50.5  | 10.5                     |                                |
| Other Universities         |        |       |        |       |                          |                                |
| Prof.                      | 49     | 32.9  | 296    | 30.8  | 6.041                    | .60                            |
| Asso. Prof.                | 41     | 27.5  | 151    | 15.7  | 3.683                    | .37                            |
| Asst. Prof.                | 9      | 6.0   | 15     | 1.6   | 1.667                    | .17                            |
| Admin.                     | 0      | 0     | 0      | 0     | 0                        |                                |
| Other                      | 1      | .7    | 2      | .2    | 2.0                      |                                |
| Unknown                    | 3      | 2.0   | 12     | 1.2   | 4.0                      |                                |
| Total                      | 103    | 69.1  | 476    | 49.5  | 4.6                      |                                |
| All Universities           |        |       |        |       |                          |                                |
| Prof.                      | 72     | 48.3  | 584    | 60.8  | 8.111                    | .81                            |
| Asso. Prof.                | 56     | 37.6  | 282    | 29.3  | 5.036                    | .50                            |
| Asst. Prof.                | 14     | 9.4   | 61     | 6.4   | 4.357                    | .44                            |
| Admin.                     | 0      | 0     | 0      | 0     | 0                        |                                |
| Other                      | 4      | 2.7   | 22     | 2.3   | 5.5                      |                                |
| Unknown                    | 3      | 2.0   | 12     | 0     | 1.2                      | 4.0                            |
| Total                      | 149    | 100.0 | 961    | 100.0 | 6.4                      |                                |

Class of 1957

| Group                           | Number |       | Papers |       | Mean Number<br>of Papers | Mean<br>÷ 7 Yrs. |
|---------------------------------|--------|-------|--------|-------|--------------------------|------------------|
|                                 | N      | %     | N      | %     |                          |                  |
| Twenty-five Strong Universities |        |       |        |       |                          |                  |
| Prof.                           | 10     | 7.9   | 88     | 20.1  | 8.8                      | 1.26             |
| Asso.Prof.                      | 13     | 10.3  | 81     | 18.5  | 6.231                    | .89              |
| Asst.Prof.                      | 6      | 4.8   | 24     | 5.5   | 4.0                      | .57              |
| Admin.                          | 0      | 0     | 0      | 0     | 0                        |                  |
| Other                           | 6      | 4.8   | 25     | 5.7   | 4.2                      |                  |
| Unknown                         | 2      | 1.6   | 0      | 0     | 0                        |                  |
| Total                           | 37     | 29.4  | 218    | 49.8  | 5.9                      |                  |
| Other Universities              |        |       |        |       |                          |                  |
| Prof.                           | 28     | 22.2  | 64     | 14.6  | 2.286                    | .33              |
| Asso. Prof.                     | 47     | 37.3  | 143    | 32.6  | 3.043                    | .43              |
| Asst. Prof.                     | 10     | 7.9   | 11     | 2.5   | 1.1                      | .16              |
| Admin.                          | 2      | 1.6   | 0      | 0     | 0                        |                  |
| Other                           | 1      | .8    | 0      | 0     | 0                        |                  |
| Unknown                         | 1      | .8    | 2      | .5    | 2.0                      |                  |
| Total                           | 89     | 70.6  | 220    | 50.2  | 2.5                      |                  |
| All Universities                |        |       |        |       |                          |                  |
| Prof.                           | 38     | 30.1  | 152    | 34.7  | 4.0                      | .57              |
| Asso. Prof.                     | 60     | 47.6  | 224    | 51.1  | 3.733                    | .53              |
| Asst. Prof.                     | 16     | 12.7  | 35     | 8.0   | 2.188                    | .31              |
| Admin.                          | 2      | 1.6   | 0      | 0     | 0                        |                  |
| Other                           | 7      | 5.6   | 25     | 5.7   | 3.6                      |                  |
| Unknown                         | 3      | 2.4   | 2      | .5    | .7                       |                  |
| Total                           | 126    | 100.0 | 438    | 100.0 | 3.5                      |                  |

Class of 1960

| Group                      | Number |       | Papers |      | Mean Number<br>of Papers | Mean $\frac{1}{2}$<br>4 Yrs. |
|----------------------------|--------|-------|--------|------|--------------------------|------------------------------|
|                            | N      | %     | N      | %    |                          |                              |
| Twenty-five Strong Schools |        |       |        |      |                          |                              |
| Prof.                      | 1      | .6    | 2      | .5   | 2.0                      | .50                          |
| Asso. Prof.                | 11     | 6.1   | 52     | 13.8 | 4.727                    | 1.18                         |
| Asst. Prof.                | 34     | 18.9  | 89     | 23.6 | 2.618                    | .65                          |
| Admin.                     | 0      | 0     | 0      | 0    | 0                        | 0                            |
| Other                      | 10     | 5.6   | 18     | 4.8  | 1.8                      |                              |
| Unknown                    | 6      | 3.3   | 14     | 3.7  | 2.3                      |                              |
| Total                      | 62     | 34.5  | 175    | 46.4 | 2.8                      |                              |
| Other Universities         |        |       |        |      |                          |                              |
| Prof.                      | 14     | 7.8   | 29     | 7.7  | 2.072                    | .52                          |
| Asso. Prof.                | 52     | 28.9  | 110    | 29.2 | 2.115                    | .53                          |
| Asst. Prof.                | 39     | 21.7  | 42     | 11.1 | 1.077                    | .27                          |
| Admin.                     | 2      | 1.1   | 0      | 0    | 0                        |                              |
| Other                      | 7      | 3.9   | 14     | 3.7  | 2.0                      |                              |
| Unknown                    | 4      | 2.2   | 7      | 1.9  | 1.8                      |                              |
| Total                      | 118    | 65.6  | 202    | 53.6 | 1.7                      |                              |
| All Universities           |        |       |        |      |                          |                              |
| Prof.                      | 15     | 8.4   | 31     | 8.2  | 2.067                    | .52                          |
| Asso. Prof.                | 63     | 35.0  | 162    | 43.0 | 2.571                    | .64                          |
| Asst. Prof.                | 73     | 40.6  | 131    | 34.7 | 1.794                    | .45                          |
| Admin.                     | 2      | 1.1   | 0      | 0    | 0                        |                              |
| Other                      | 17     | 9.5   | 32     | 8.5  | 1.9                      |                              |
| Unknown                    | 10     | 5.5   | 21     | 5.6  | 2.1                      |                              |
| Total                      | 180    | 100.0 | 377    | 60.0 | 2.1                      |                              |

Class of 1962

| Group                      | Number |       | Papers |       | Mean Number<br>of Papers | Mean $\frac{\div}{2}$<br>2 yrs. |
|----------------------------|--------|-------|--------|-------|--------------------------|---------------------------------|
|                            | N      | %     | N      | %     |                          |                                 |
| Twenty-five Strong Schools |        |       |        |       |                          |                                 |
| Prof.                      | 1      | .4    | 2      | 1.1   | 2.0                      | 1.0                             |
| Asso. Prof.                | 1      | .4    | 3      | 1.7   | 3.0                      | 1.5                             |
| Asst. Prof.                | 49     | 18.8  | 45     | 25.3  | .918                     | .46                             |
| Admin.                     | 0      | 0     | 0      | 0     | 0                        |                                 |
| Other                      | 12     | 4.6   | 7      | 3.9   | .6                       |                                 |
| Unknown                    | 15     | 5.8   | 16     | 9.0   | 1.1                      |                                 |
| Total                      | 78     | 30.0  | 73     | 41.0  | .9                       |                                 |
| Other Universities         |        |       |        |       |                          |                                 |
| Prof.                      | 7      | 2.7   | 5      | 2.8   | .714                     | .36                             |
| Asso.                      | 30     | 11.5  | 12     | 6.7   | .4                       | .20                             |
| Asst.                      | 115    | 44.2  | 69     | 38.3  | .6                       | .30                             |
| Admin.                     | 1      | .4    | 1      | .6    | 1.0                      |                                 |
| Other                      | 9      | 3.5   | 7      | 3.9   | .8                       |                                 |
| Unknown                    | 20     | 7.7   | 11     | 6.2   | .6                       |                                 |
| Total                      | 182    | 70.0  | 105    | 59.0  | .6                       |                                 |
| All Universities           |        |       |        |       |                          |                                 |
| Prof.                      | 8      | 3.1   | 7      | 3.9   | .875                     | .44                             |
| Asso. Prof.                | 31     | 11.9  | 15     | 8.4   | .484                     | .24                             |
| Asst. Prof.                | 164    | 63.0  | 114    | 64.1  | .695                     | .35                             |
| Admin.                     | 1      | .4    | 1      | .6    | 1.0                      |                                 |
| Other                      | 21     | 8.1   | 14     | 7.8   | .7                       |                                 |
| Unknown                    | 35     | 13.5  | 27     | 15.2  | .8                       |                                 |
| Total                      | 260    | 100.0 | 178    | 100.0 | .7                       |                                 |

TABLE 4. PERCENTAGES HAVING GIVEN NUMBERS OF PAPERS

| Percentages | 0 Papers | 1 Paper | $\leq 1$ Paper | $> 1$ Paper |
|-------------|----------|---------|----------------|-------------|
| 1945        | 34.6     | 15.4    | 50.0           | 50.0        |
| 1948        | 19.5     | 12.2    | 31.7           | 68.3        |
| 1951        | 18.4     | 20.3    | 38.7           | 61.3        |
| 1954        | 25.4     | 15.7    | 41.1           | 58.9        |
| 1957        | 35.8     | 23.0    | 58.8           | 58.8        |
| 1960        | 39.6     | 22.1    | 61.7           | 38.3        |
| 1962        | 60.8     | 23.2    | 84.0           | 16.0        |

TABLE 5. NUMBER AND PERCENT HAVING  $> 1$  PAPER A YEAR

| Year | No. With $> 1$ Paper a Year | Percent |
|------|-----------------------------|---------|
| 1945 | 5                           | 19.2    |
| 1948 | 26                          | 21.1    |
| 1951 | 39                          | 18.0    |
| 1954 | 37                          | 14.9    |
| 1957 | 24                          | 10.6    |
| 1960 | 35                          | 11.4    |
| 1962 | 26                          | 6.4     |